9 DEVELOPING THE MATHEMATICS TEACHER AS MENTOR THROUGH TEAM-BASED APPROACHES TO MENTORING[i]

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This chapter will discuss the context for the encounters between mentor, pre-service teacher and supervising tutors and provide an example of how tutors, mentors and pre-service teachers worked together to develop a tool and process to enhance the observation and feedback experienced by pre-service teachers. We will describe the experience of pre-service teachers, school-based mentors and supervising tutors as they work at the boundary between the practices of schooling and teacher education and exemplify how a team based, enquiry focused approach supports and mediates learning of all three agents through identification, co-ordination, reflection and transformation.

INTRODUCTION

> *"The year after...I secured a full-time teaching position at Aramis Park High School....There was one other PE teacher at Aramis when I arrived and we both shared a staff room with the History/Geography teachers. They were a very friendly group, and were occasionally given to practical jokes, especially with first year teachers....Understandably, I didn't take much notice when my name went up on the board to volunteer as a practicum advisor. Just another joke! Needless to say I was a little*

> *surprised when, on the Wednesday before an introductory practicum for student teachers at Aramis High, a young man knocked on the History/Geography staff room door and asked to speak to 'Mr Clarke', his practicum advisor. This was my first year of teaching and here was my first student teacher".* (Clarke 1997: 166)

Although the situation described in this example may seem extreme, we suspect that a significant number of teachers find themselves as mentors with scarcely more preparation. Moreover, it is clear that the position of mentor to a pre-service teacher is a key role in teacher education and the quality of this relationship can have a significant impact on the professional learning of both the pre-service teacher and mentor.

Our premise is that in training programmes that emphasise school experience, tutors, pre-service teachers and their mentors are engaged in a process of boundary crossing (Akkerman & Bakker 2011; Engeström 1999). From a situative perspective the pre-service teachers are moving from peripheral participation in the school practice of teaching to recognised membership of the community of practice of teaching of the school (Wenger 1998). At the same time as the pre-service teacher is moving from being a student with a base at an accredited provider (such as a university) to becoming a teacher, the mentor is crossing a practice boundary, from school teacher to teacher educator. Supervising tutors, too, are involved in this process through which we problematise our practice by a process of enquiry.

Interactions between the pre-service teacher and mentor also often occur at a boundary between the specific practices and expectations of the accrediting provider (often a university) and the school. In practice-based programmes, such as those to be found in England, pre-service teachers, their supervising tutors and school-based mentors can also find themselves working at a conceptual boundary, between the competency-based training and monitoring that is often found in schools and the reflective mode of professional learning that is promoted by accrediting bodies such as universities. Each approach can bring with it artefacts of practice and specific discourses; one highly regulatory, the other more discursive. These boundary crossing situations can be sources of tension, but are also potential sources of learning. For example, Akkerman & Bakker (2011) in their review of literature on boundary crossing, distinguish four potential learning mechanisms which can take place at boundaries: identification, co-ordination, reflection and transformation.

MODELS OF MENTORING

One model of initial teacher education, for example that adopted by the current (2012) English government which uses the word 'training', could be characterised by the scenario where the mentor is the 'expert' who guides the 'novice' teacher in their role as they 'learn the ropes'. The novice produces lesson plans under the guidance of the mentor and attempts to carry out activities with learners to support their developing understanding of mathematics. In this rather mechanistic model, learning mathematics and learning to become a teacher are unproblematic activities characterised by a transfer of knowledge from the expert to the learner (the school student or pre-service teacher). Variations on this theme might focus on the relationship between the mentor and pre-service teacher with the mentor interpreting their role slightly differently as, for example, a colleague of the pre-service teacher or the pre-

service teacher as an apprentice who learns the 'craft'. In this arrangement the supervising tutor becomes a quality control figure for both the mentor and pre-service teacher whose visits to 'check up' on the progress of the pre-service teachers and who may also have a role in evaluating the quality of mentoring. Underpinning these activities is a model of increasing measurement and accountability in the education system. However, as Edwards, Gilroy and Hartley (2002) argue, apart from its appeal to 'common sense', this approach has little rational or evidential base (p.3).

Research into learning mathematics (Hiebert & Carpenter 1992; Nunes, Bryant & Watson 2009) and research into learning to be a teacher (Eraut 1994; Goos 2008; Lave & Wenger 1991; Oliveira & Hannula 2008) challenges these certainties. For example, for at least two decades there has been a consensus among researchers that learning mathematics should be viewed: "as both a process of active individual construction and a process of enculturation into the mathematical practices of the wider society" (Cobb 2005: 40). Moreover, it could be argued that teachers of mathematics learn to teach by "building up a repertoire of increasingly informed interpretations of affordances, and responses which make use of those affordances *in the act of teaching*" (A. Edwards et al. 2002: 110). This is a complex situation and in this context the role of the mentor moves from that of a 'trainer' to a more nuanced agent. Indeed, it is clear that there is no straightforward step from an experienced classroom teacher of mathematics to a mentor of pre-service teachers, even though many mentors appear to have been chosen on this basis.

OPPORTUNITIES FOR LEARNING

Supervising tutor, mentor and pre-service teacher have different mental maps, different observational skills and different levels of access to knowledge. Our argument is that the diverse perspectives and practices experienced by pre-service teachers, their mentors and supervising tutors provide opportunities for professional learning through *dialogicality*, drawing on Bakhtin's (1981) philosophy in which learning is a process that involves multiple perspectives and multiple parties where power may be more equally shared between them (Flecha 2000).

Our focus here is on classroom observation and feedback by school mentors and on the use of an observation tool as an artefact to enhance pre-service teachers' and mentors' learning. We will argue that in this activity both the mentors and the pre-service teachers engage in developing their professional identity, shaped by sometimes differing practical expectations, academic demands and cultural values of both an accrediting provider, such as a university, university and a school. In the case where joint observations are shared with supervising tutors we would also suggest that there is the potential for significant professional development and learning to be triggered by crossing both real and metaphorical boundaries. As researchers we also believe that the educational design process (Shavelson, Phillips, Towne, & Feuer 2003) enables us to engage with practice in a significant development of our role. We believe it is essential that the tools offered to pre-service teachers and their mentors are supportive of divergent learning outcomes, through which each pre-service teacher and mentor has the opportunity to transform teaching practices, not simply replicate existing ones. This is vital to address current challenges in teacher education of transforming learning in a context of rapid change.

There is a growing interest in the development of 'boundary objects' as artefacts which fulfil a bridging function (Edwards, Lunt & Stamou 2010; Edwards & Mutton 2007). We suggest that the activity of classroom observation and feedback by school mentors is a boundary activity where a range of learning opportunities occurs and that artefacts can be designed to enhance these opportunities. We will outline the development of an observation tool as a boundary object which mediates the learning undertaken by pre-service teachers and their mentors (and supervising tutors) as they work at the boundary between the practices of schooling and teacher education.

DIFFICULTIES WITH CURRENT PRACTICE

Pre-service teachers in England experience multiple cycles of observation and feedback by their mentor during their initial teacher education. Such observation absorbs many tens of hours, forms the basis of the mentoring, monitoring and reporting processes that are associated with compliance to programme requirements, and provides the pre-service teachers with their benchmarks of progress. For some pre-service teachers, observation can turn into a purely bureaucratic activity, which does little to engage them or their mentor in anything more than incremental target setting and monitoring. Hargreaves (2000) has characterised such itemisation and categorisation teachers' of work and recognition as 'checklists of performance standards or competencies' (Hargreaves 2000: 152). Such a view can affect pre-service teachers' experiences of professional learning in school and their mentors' expectations of their role.

The problem for pre-service teachers is that their initial framing of their classroom experience is likely to be their 'default' settings carried with them tacitly (Eraut 2000) from previous expectations and experiences in the classroom (Barnes 1992). It is difficult to consider alternatives if you have little experience of them.

> Real change is not simply a matter of psychology, of convincing yourself and then acting differently. Real change is based on becoming aware of possibilities which were not previously available….at the heart of change is the recognition of new possibilities for acting
>
> (Mason 2002: 144).

This might also be said to apply to many mentors in terms of their experience of teacher pedagogy. Established practice does little to break this cycle, and this is potentially exacerbated when former pre-service teachers become mentors and reproduce their own experience with their mentees. Evidence from a mixed methods longitudinal study (Tracey et al. 2008), shows that observation and feedback practice in English schools rarely supports teachers' self-development as reflective practitioners and tends to undermine any sense of agency on the part of teachers.

Nonetheless, experience suggests that some pre-service teachers find the observation process to be inclusive, reflexive and genuinely developmental for both parties. Our interest as tutors is in promoting this process during teaching placements and in developing our own understanding of it. In doing so, we recognise, along with Edwards and Blake (2007), that

even reflective practice is coded within the political and economic contexts within which initial teacher education operates. However, the aim is to foster an approach which goes beyond low-level reflection as part of a technical-rationalist paradigm (Edwards & Blake 2007). The development of a tool which affords the learning opportunities which pre-service teachers might experience by sustained interactions with their mentors and which focuses on their development as teachers is therefore a priority.

INVESTIGATING STUDENTS' EXPERIENCE OF OBSERVATION AND FEEDBACK

Our investigations (Lofthouse & Wright 2012) suggest a model of differentiated impact of observation and feedback for pre-service teachers. Four levels are identified: 1) At a basic level the pre-service teachers sees observations as opportunities to gain feedback and have their progress in meeting specific targets monitored by their mentor. 2) Pre-service teachers who appear to have been more activated by the observation and feedback session demonstrate engagement in self-evaluation of the specific lesson. 3) Other student teachers recognise a cumulative impact as observations enable them to consider their progress over time alongside their mentor. 4) At the most sophisticated level, pre-service teachers show how the process has helped to embed reflection into their suite of professional skills, thus increasing their capacity to judge and develop their own practice. These levels are further defined and exemplified below.

A NEW OBSERVATION TOOL

In response to these investigations a new tool for lesson observation was designed (Lofthouse & Wright 2012). As our initial teacher education programme promotes a practitioner enquiry mode of learning, the development of the observation tool was premised in the belief that *questions* provide the key to learning (M. L. Blanton, Berenson & Norwood 2001). A question can stimulate the learner's zone of proximal development (Vygotsky 1978), be the trigger for a learning conversation or the basis for an extended enquiry. The challenge was to ensure that questioning could be built into the observation and mentoring process, and plays a part in enhancing professional development (Lofthouse et al. 2007). The objective was to promote enhanced reflection, as defined by Dewey who proposed that:

> [R]eflective thinking, in distinction from other operations to which we apply the name of thought, involves (1) a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates, and (2) an act of searching, hunting, inquiring, to find material that will resolve the doubt, settle and dispose of the perplexity
>
> (Dewey 1993: 12).

We were therefore valuing thoughtful tentativeness and a search for evidence.

Thus the new tool promoted questions from both the pre-service teacher and the mentor observer. The link to practitioner enquiry was made as the co-participants owned the questions which were triggered by what was currently going on in their practice which were 'causing some sort of disturbance' (Lofthouse et al.: 173). Hence the use of 'enquiry' in

Schön's sense where for professional practitioners: 'practice is a kind of research' where 'their enquiry is a transaction with the situation in which knowing and doing are inseparable (Schön: 165, our emphasis). Dewey's (1933) influence was also strong as we were challenging a belief that practice and theory are dichotomous, and accepting that "all inquiry is practical, concerned with transforming and evaluating the features of the situations in which we find ourselves" (Hookway 2010: Section 4.2). The hypothesis was that by engaging observer and observed as agents in the same process, both would learn.

DESIGN PRINCIPLES

Three key considerations shaped our practice as tutors and the design of the observation models and the research into their application and impact. Firstly, the belief that a key feature of learning to teach is dealing with inconsistencies, incomplete theoretical frameworks and 'situations of uncertainty, instability, uniqueness and value conflict' (Schön 1983: 49). Edwards and Blake (2007) argue that for pre-service teachers "possibilities for change are dependent on the availability of multiple, competing perspectives of teacher identity and practice" (p.50). Observations that are based on simple reporting and/or evaluation of practice seem unlikely to support the reflective re-framing of experience (Schön 1983) needed to deal with these tensions or provide these multiple perspectives. Secondly, given the frequency and significance of the observation process in initial teacher education, a pre-service teacher should feel a sense of ownership and shared responsibility for them and the related discussions. If a pre-service teacher is forced to rely on the observer for feedback, and if this is simply framed as an evaluation of competence, it seems likely that their genuine engagement with the process will be put at risk. Thus the design used a question based

approach to observation to throw back the initiative to the pre-service teacher, putting them in the role of active learner (Branton et al. 2001).

Finally, we theorised that this new observation 'tool' (Jahreie & Ludvigsen 2007; Perks & Prestage 2008) could be an effective boundary object and change the approach taken to observation, making the link between practice evidence and conceptualising classroom processes and outcomes. Akkerman and Bakker's (2011) review claims that: "boundary objects have different meanings in different social worlds but at the same time have a structure that is common enough to make them recognizable across these worlds" (p.140), hence our conjecture that the observation tool could act as an artefact mediating the social worlds of school and accrediting provider, particularly where a supervising tutor could be involved in a joint observation.

THE DEVELOPMENT OF THE TOOL

The development of the tool followed an educational design process. Shavelson et al (2003: 26) (cited in Cohen et al. 2011) suggest that the key principles of design studies are that they are: a) iterative; b) process focused; c) interventionist; d) collaborative; e) multileveled; f) utility oriented and g) theory driven. Hence the design of the tool led to an iterative, collaborative, process-focused approach to the development of the observation tool. Pre-service teachers and their mentors were encouraged to experiment with, and report on, their observation experience. Their feedback helped us to define the role of observation in the process of professional learning and to review the nature of the mentoring relationships

which emerged. The development process was conducted over three years enabling the tool to be refined with three cohorts of pre-service teachers.

The model to emerge consisted of four stages which were captured on a proforma (see Figure 9.1):

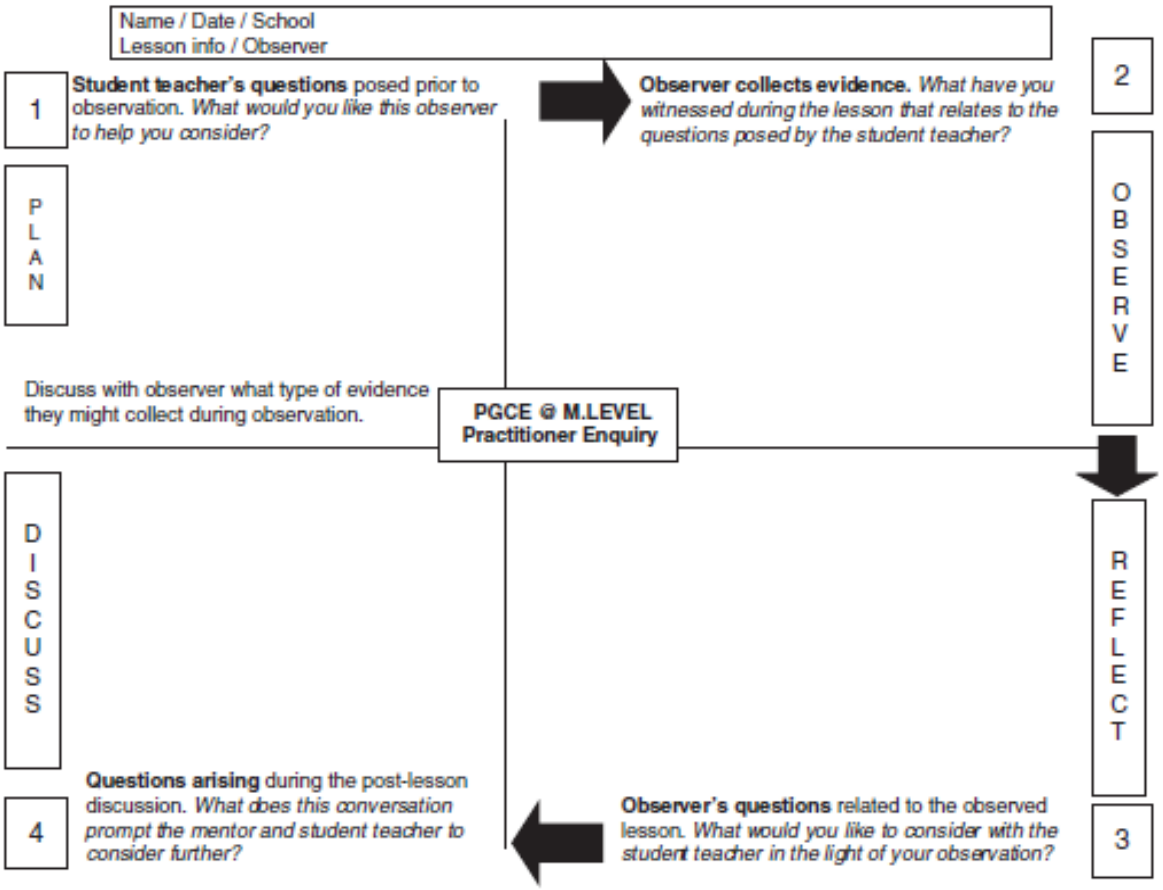

Figure 9.1: Observation proforma

Stage 1: pre lesson

The pre-service teacher records question(s) prior to the observation which they would like the observer to consider during the lesson. Often the first step to reflection is to be aware of a "disturbance" (Mason 2002) and the first stage in our revised observation tool is for the student to identify an issue which has caused some "disturbance" for them and to pose a question(s) relating to this issue.

Stage 2: gathering evidence:

This stage required the observer to document evidence emerging from the lesson that related to the pre-service teacher's question(s). As such the observer was prompted to carefully analyse the classroom activity and identify evidence which they believed related to the question initially posed by the pre-service teacher. The observer was then able to support the pre-service teacher in 'framing' the situation by providing evidence or a witness statement composed of an account composed of '*brief but vivid'* (Mason 2002: 50) incidents. The intention was to create opportunities for joint reflection on a shared object, i.e. the observation tool, which itself was descriptive, rather than evaluative, and allowed the student teacher to insert their own interpretation into the observation.

Stage 3: posing questions: (Concurrent with stage 2)

The challenge here is for the observer to transform their evaluative judgements into questions for the pre-service teacher relating to the lesson and the question posed by the pre-service teacher. Clearly the quality of the questions posed is crucial in providing a stimulus for the

novice teacher to reframe their practice and this is a fruitful area for development when we work with mentors.

Stage 4: Post lesson discussion:

The observation debrief is then based on discussing some or all of these questions, and leads to recording of questions that are prompted by this process. This stage involves the mentor and pre-service teacher addressing the issues and questions raised by the questions captured in the first and second stage of the tool. Questions arising from this discussion may then feed forward and provide the first stage of a subsequent observation, form the basis of discussions with other colleagues or pre-service teachers, or perhaps trigger an action enquiry or an investigation of relevant literature or policy.

DISCUSSION

In practice it was found that the 'tool' shifted the focus of observation to practice as enquiry. In this instance practice can be defined as both the pre-service teacher's classroom practice and the mentoring practice of experienced teachers. While observation of and feedback on classroom practice of pre-service teachers by experienced teachers has become a central feature of the learning landscape of initial teacher education in England it can become a focus for a clash of cultures. The pre-service teacher and their mentor are working at a border between two 'Zones of Promoted Action' (Blanton, Westbrook & Carter 2005; Valsiner 1997), that of the school which may be dominated by the performative culture (Ball 2003) and that of the accrediting provider with its more discursive and reflective culture and emphasis on practice as enquiry. The barring of 'judgements' and the encouragement for the

observer to reformulate their evaluations as questions was a key element in transforming the relationship and the perspective of the mentor as observer.

Although pre-service teachers and mentors find themselves in these potentially problematic 'borderlands' when discussing classroom practice, the situation can create opportunities for learning. As previously noted, Akkerman and Bakker (2011) argue that boundary crossing situations create the opportunity for dialogic learning as a process involving multiple perspectives and multiple parties and the mechanisms of dialogic learning involve identity, co-ordination, reflection and transformation.

Identity and ownership

"What is typical in identification processes is that the boundaries between practices are encountered and reconstructed, without necessarily overcoming discontinuities. The learning potential resides in a renewed sense making of different practices and related identities." (Akkerman & Bakker 2011: 144). As pre-service teacher and mentors contributed questions for each others' consideration the observation form was passed back and forth. This process seemed to reinforce both parties' desire to discuss the questions that each had written.

As one student teacher stated, *"... nobody really led. We would ask questions to each other as we were exploring"* and another wrote that he *"felt more ownership"* and that it *"allowed me to have more confidence as it was more of a collaborative discussion with my mentor".* In this context pre-service teachers appeared more willing to initiate discussions around their chosen queries or disturbances thus enhancing their sense of agency or 'ownership' of the process. These accounts suggest that the tool provided a *dialogical* forum where mentors and

pre-service teachers were negotiating their roles in the borderland between school and the accrediting provider. The focus on questions encouraged the mentors to focus on the pre-service teacher's learning and on their own challenge to formulate effective questions (cf. Bloom's 1956 taxonomy).

Co-ordination

As a 'boundary object' the pro-forma serves as a channel of communication and co-ordination between the agents (mentors, pre-service teachers and supervising tutors) participating in teacher education. "The potential in the coordinative mechanism resides not in reconstructing but in overcoming the boundary, in the sense that continuity is established, facilitating future and effortless movement between different sites." (Akkerman & Bakker 2011: 12)

Reflection

"Where identification represents a focus on a renewed sense of practices and a reconstruction of current identity or identities, reflection results in an expanded set of perspectives and thus a new construction of identity that informs future practice." (Akkerman & Bakker 2011: 147). Questionnaire and interview responses revealed that the enquiry-based observation tool gave pre-service teachers opportunities to focus on specific areas of pedagogy with their mentor:

> *I think we were trying to get to the bottom of it [explanation]. In a way I don't think we did come up with a conclusion to it, but all the things, the process of going through it is helpful as well in terms of exploring the issue more deeply than you would say in a normal lesson observation; where you would have a number of targets at the end that you would talk about on a more surface level. Whereas this probed further for both of us, and helped M [mentor] think about his explanation, which helped me.*

A mentor reinforced this:

> *The proforma questions provide the base for starting the discussion but this process was still open to suggesting further questions from both parties. This meant that the complexities of the issue were revealed and therefore prompted greater student understanding.*

Transformation: Working on areas of uncertainty or disturbance

"Transformation leads to profound changes in practices, potentially even the creation of a new, in-between practice, sometimes called a boundary practice." (Akkerman & Bakker 2011: 147) The focus on questions seemed to permit pre-service teachers to reflect, discuss and experiment at the boundaries of their professional knowledge or in areas of uncertainty. These types of experiences also created an interesting challenge for the pre-service teachers in relation to the notion of expertise, and as such appeared to reassure them that developing fully comprehensive knowledge and every possible professional skill was unrealistic during their initial teacher education. This led to the recognition that becoming reflective practitioners was what had made a

real difference to their achievement as teachers. For mentors and supervising tutors, this process opens up the classroom observation and feedback process as a research tool where the quality of questions becomes a clear priority.

FINAL REMARKS

Encouragement for further enquiry is given by Edwards and Mutton (2007) who investigated "how identities are enacted; and systems sustained or adjusted as people work at the boundaries of schools and departments of education in universities" (p.504) and provided an extensive account focused on the experience of mentors and conclude that:

> If the tool is to maintain its function as an artefact which brings the two systems together it would seem that it needs to retain, at least on occasions, its position as a boundary object which is jointly worked on at the boundaries of the systems. That is, jointly produced tools, such as assessment instruments, need to be revisited to keep the collaboration alive
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> (p.509)

The need to 'revisit' corresponds to the iterative nature of design studies (Shavelson et al. 2003) and continuing enquiry provides opportunities for revisiting the tool and gathering data from the mentors. Observation can be considered as a boundary activity which exists at a potentially multi-faceted boundary. Both the mentors and the pre-service teachers are engaged in developing a new professional identity, shaped by sometimes differing practical expectations, academic demands and cultural values of both an accrediting provider, such as

a university, and a school. Practices, such as observation and feedback, are critical in defining the experience of pre-service teachers and mentors.

As supervising tutors, we are finding ourselves in a rapidly changing educational landscape and we would suggest that this kind of research and design process will enable us to actively engage in reshaping our own professional identities. Significant professional development and learning can be triggered by crossing both real and metaphorical boundaries and as such it is essential that the tools developed with pre-service teachers and their mentors are supportive of divergent learning outcomes, through which each pre-service teacher and their mentor have the opportunity to transform teaching practices, not simply replicate existing ones. This is vital if, as Hargreaves predicted in 2000, we have entered a post-modern era in which "the context of teaching is changing dramatically, and older modernistic versions of professional and professionalization will not be sufficient to address these significant changes" (Hargreaves 2000: 172).

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